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To Compare the Effectiveness of Brain Gym Program versus Body Activated Learning Program on 6-12 Year Old Students' Handwriting Skills and Postural Alignment

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ABSTRACT

This study was set out to assess the efficacy of Brain gym program and Body Activated Learning program in improving handwriting performance and postural instability. A total of 180 students of grade 1-6 were screened out using the Handwriting Proficiency Screening Questionnaire, out of which 60 students having Handwriting deficiency were randomly assigned into one of the two intervention groups and a control group. The intervention group participated in the movement-based program on a daily basis for 30 minutes for 8 weeks. Student's handwriting and posture were assessed using Test of handwriting skill- Revised (TSH-R) and New York posture rating scale (NYPR) respectively pre and post-intervention.

Within the study handwriting skills especially writing from memory, dictation, and copying and postural alignment significantly improved following Brain Gym and Body Activated Learning program as compared to the control group ($F(6, 112) = 3.822$, $p = .0001$; effect size (f) = 0.25). Body Activated Learning Program was more effective for addressing handwriting skills and postural alignment than Brain Gym program. From the result, we concluded that such movement-based programs can be utilized for the enhancement of handwriting skills and postural alignment for school children.

KEYWORDS: *Handwriting, movement, memory, Posture*

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1. INTRODUCTION

Handwriting is a complex process of managing written language by coordinating eyes, arms, hands, pencil grip, letter formation and body posture. (American occupational therapy association-2019) With respect to children, academic school activities can be considered as a major domain of their occupational work performance (Ms. Sid Nour El Houda-et-al, 2016)

Handwriting is an important means of communication that enables the expression, recording, and transmission of ideas of students throughout their educational careers. It has been estimated that elementary school–age students may spend up to one-quarter to one-half of their school day engaged in paper-and-pencil tasks, with writing as the predominant task (Duval-White-et-al, 2013).

Unfortunately, handwriting difficulties are commonly observed in children at primary schools and particularly in boys. It is reported that the prevalence of handwriting difficulties among school-age children varies between 10%–34% depending on grade, selection criteria, and instruments used (Sara Rosenbulm-et-al, 2006). If a child has difficulties with aspects of handwriting performance such as speed and/or legibility, it can significantly affect the progress in the classroom and lead to academic underachievement (Mellissa Prunty & Anna L. Barnett, 2017) Handwriting challenges early in life may have negative effects on learning and academic performance. Those children who do not succeed in developing proficient handwriting are defined by some authors as "poor hand writers" and by others as "dysgraphic".The handwriting quality of children

with difficulties has been described as "poor" and can be characterized by inappropriate spacing between letters or words, incorrect or inconsistent shaping of letters, poorly graded pencil pressure, letter inversions, and mixing of different letter forms (Sara Rosenbulm-et-al, 2006).

Writing posture, upper-extremity stability and mobility are the ergonomic factors that play a very important role when child engages in writing. Posture is the "biomechanical alignment; the spatial arrangement of body parts; the relative position between segments; and the body attitude to perform tasks' (Lisa Barona McRoberts, 2013). Body posture is generally considered to have an important influence on the efficiency of the writing process and product. Clinicians have observed that trunk instability due to low muscle tone among children prevents them from making necessary postural adjustments while focusing on activities that require fine motor skills such as handwriting (Sara Rosenbulm-et-al, 2006).

To address handwriting difficulties, several curriculum-based handwriting programs have been developed like:

Handwriting without Tears: HWT is a multisensory-based handwriting curriculum, can be implemented in the classroom by both teachers and occupational therapy practitioners.

D'Nealian Handwriting: Donald Neal created the D'Nealian handwriting program and began introducing it to teachers in 1968. It involves the original continuous stroke handwriting techniques. With D'Nealian Handwriting, all students learn a few simple connecting strokes-and this is helpful for children to move from manuscript to cursive writing. It has become one of the most widely accepted methods for teaching handwriting.

Callirobics: It involves a unique concept in handwriting exercises. They consist of repetitive simple writing patterns (straight and curved lines) set to music. The music relaxes the participants and adds rhythm to their exercises. Each exercise takes about 2 minutes.

Write-On Handwriting™ combines revolutionary technology with written practice to build handwriting fluency through a unique 2-step approach. Individualized instruction begins with an interactive digital workbook and is reinforced by written practice in a paper workbook.

The Write Start program: it another classroom-embedded intervention, helps in promoting writing fluency in school children.

Besides *occupational therapist* can provide equipment and adaptations like slope boards or slanted desk tops, pencil grips etc. Encourage correct sitting position (allow the child to sit comfortably, with feet flat on the floor and bottom well back on the seat, table and chair should not be too high or too low and proper paper position (It should be tilted slightly) is also helpful in improving academic performance of child (NHS Wales Informatics Services)

Brain gym is becoming a beneficial modality to use within occupational therapy. It also provide an added level professionalism, which is important for everyone who is sceptical of either how brain gym combines with occupational therapy or extent to which OT itself is recognized profession (Shoshanah Shear, 2019). Brain Gym® is an educational kinesiology program that is implemented internationally in over 87 countries. Brain Gym® is define as a set of several exercises that are done as a suggested solution for many physical and psychological challenges (Katy held, 2011) Brain Gym® idea was originally developed by the educators and reading specialists Dr. Paul E. Dennison and Dr. Gail E. Den back in 1970s. Under the Brain Gym® umbrella, there are 26 exercises and each exercise has organized steps of special moves that connect all body sensors with each other (Dua'a al herbawi, 2018)

Brain gym system: Increases short term and long term memory, Improves reading and maths skills, Improves self-awareness skills, Supports behavioural management by reducing stress.

Brain gym activities can be performed occasionally, routinely or even daily. They are safe simple an only takes few minutes to complete. And can be performed in group or individually (Katy held, 2011)

There is also an innovative approach that is becoming widely accepted for school students. *Body Activated Learning* is a, relatively new sensory-based program, includes 27 sensory-based movement breaks, designed to be implemented on an individual basis or in group to support student attention and engagement, task completion, reading and writing skills. Created by occupational therapists Schmalle in collaboration with Andrade, Cardone-Bunker and Michel (2015)

This sensory-based movement program includes 5 part process: 1) Assess, 2) Optimize (energize and restore), 3) Activate, 4) Regroup and 5) Get ready to learn.

It is recommended to choose 1 exercise and to rotate the exercise from each category for maximum stimulation to sensory stimulation.

The entire process was set up to take approximately 3-5 minutes to complete and can be used throughout the day. The categories of energize, activate and restore/regroup were used. The **Energize component** activities includes: vestibular and proprioceptive input, speed and intensity, require minimal skill and are primarily alerting in nature.

The **Activate category** has 5 sections: a) move, learn, connect, b) sit up, listen, engage, c) get ready, get set, go, d) sit-up, draw, create, e)vision boosts. The activities require motor planning, incorporate vestibular input, visual tracking and/or vision to lead the actions and are primarily alerting.

Regroup component activities use rhythm, deep pressure, respiration, vision breaks and stretching and are primarily calming.

It is evident that students with difficulties in sensory processing, sensory awareness usually have handwriting problem and combining sensory activities with handwriting would be effective way to address both areas (Melissa keller, 2001). It is well known that control of posture is a complex multisensorial task based on vestibular, visual, and somatosensory information arising from sensory sources such as muscle, skin, and joints, emphasizing on activities that provide enhanced vestibular and proprioceptive sensation helps simultaneously in improving posture (Rajesh, 2014).

1.1. Purpose

There is little evidence available in the literature with regard to effectiveness of Brain Gym® activities and Body Activated Learning Program in improving handwriting and posture. According to several authors, available studies have questionable research integrity, and deficit based theoretical explanation. The issue of Brain Gym also revolved around the published report that has lack of details and methodological inconsistencies (Spaulding,2010, Hyatt, K. J. 2007) There are minimum numbers of studies available considering the Brain gym and Body Activated Learning activities in school settings, especially on Indian population. Hence the purpose of the study was to compare the effectiveness of Brain gym program versus Body Activated Learning program in improving handwriting performance and postural instability among 6-12 years old students.

1.2. Hypothesis

Experimental hypothesis

- HA1: There will be significant improvement in the handwriting skills and postural alignment of children who receive Brain gym program or Body Activated Learning program compared to the children who receive no intervention.
- HA2: There will be significant improvement in the handwriting skills and postural alignment of children who received Body Activated Learning program compared to the children who receive Brain gym program

Null hypothesis

- Ho1: No significant improvement would be seen in any of the three groups.
- Ho2: There will be significant improvement in the handwriting skills and postural alignment of children who receive Brain gym program compared to the children who receive Body Activated Learning program

2. Methods

2.1. Participants

Students in grade 1-6, attending school in a regular educational environment and students with reported handwriting deficiency in HPSQ and associated poor postural alignment were included in the study. Students having medical, psychiatric or neurological disorders or students already taking intervention for handwriting and postural difficulties were excluded.

A total of 180 students of grade 1-6 were screened out using Handwriting Proficiency Screening Questionnaire, out of which 60 students found to have Handwriting deficiency. The mean age of children was 8.9 years (M = 8.9 years, SD = 1.89 years). Out of 60 children 70% (N=14) were boys and 30% (N=6) were girls in each group. Overall 80%- 90% students were right handed and 10%- 20% children were left handed. 70% -85% children used manuscript and 15%- 30% children use cursive handwriting format.

2.2. Procedures

The proposal of the study was approved by the Institutional review committee of Jamia Hamdard University. Necessary Permission was taken from the principal of the school. Based on the inclusion criteria the students of the class 1st to 6th in the age group of 6 to 12 years were selected for the study .Their age was confirmed from the school records with the help of class teachers. Children were screened out for handwriting deficiency using Handwriting proficiency screening questionnaire filled in by school teachers. Written consent was taken from each child's parents/guardian who showed difficulty in handwriting. Children were assessed using standardised assessment tool. Students were systematically assigned to BG group, BAL group and control group. Following that Movement-based program was provided to the intervention groups and then its effect was analysed on handwriting and posture of the students.

2.3. Measures

2.3.1. Handwriting proficiency screening questionnaire (HPSQ): Rosenblum, S. (2008)

Handwriting Proficiency Screening Questionnaire (HPSQ) developed by Sara Rosenblum. The HPSQ is a ten-item, reliable and valid questionnaire developed to identify school-aged children with handwriting deficiency based on their teacher's observation. Items are scored on a 5-point Likert scale from 0-never to 4-always, and then summed to a final score.

2.3.2. Test of handwriting skill- Revised (TSH-R): Michael Milone (2007)

The THS-R is a standardized test developed by Michael Milone, to measure how a child writes with his or her hand, letters and words and sentences and numbers, either spontaneously or from dictation or by copying and can be administered individually or to a group of children with age range up to 18 years, 11 month. The THS-R also assesses writing speed, letter reversal, and case substitutions.

2.3.3. New York posture rating scale (NYPR): Lisa Barona McRoberts (2013)

It is cheap, easily and rapidly applicable postural assessment method. The rating chart is used to assess 10 areas of body and a score is allocated as: 10 (correct posture), 5 (fair posture), and 0 (poor posture). The scores of the 10 body alignment segments are summed, allowing a range of overall score between 0 and 100, with a score of 100 representing ideal posture.

2.4. Intervention

Sessions: Brain Gym and Body activated learning sessions were provided on daily basis for 30 minutes (In a group – 5 students in each group) for 8 weeks.

BG Group exercises: Lazy 8 and PACE was done daily by the students, besides these different activities were selected from each category of Midline movements, Lengthening activities and energy exercises as shown in Table-1

BAL Group exercises: Different activities were selected from Energize component, activating category and regrouping component as shown in Table-2

Control group participated in handwriting activities or assignments as a part of their school curriculum.

2.5. Analytic plan

Complete data was gathered in the form of a master chart made on Microsoft Excel 2010. The statistical analysis was conducted using Statistical Package for the Social Sciences 21 (SPSS v.21). Statistical significance at p </= 0.05 was assumed.

To determine the effectiveness of interventions on Handwriting skill, a repeated measures analysis of variance (ANOVA) was performed on the difference scores (posttest–pretest). The three handwriting scales (memory, dictated, and copied) were used as the within-subjects factor and group as the between-subjects factor.

One-way analysis of variance (ANOVA) was performed on the difference scores (posttest–pretest) to analyse the effectiveness of intervention on postural alignment.

An effect size index (*f*) was also calculated to estimate the strength of any treatment effects and to guard against possible type II errors using the formula $f = [SSb / SSe]$ ½ (Peggy L. Delton et-al, 2006)

A paired-samples t-test was conducted to assess the effectiveness of individual intervention group and to compare the differences between the intervention groups (BG versus BAL Group). Descriptive analysis included percentages, means and SD.

3. Result

This includes, First preliminary analyses, to demonstrate that the three groups were equivalent prior to intervention and Second, primary analyses are presented in relation to the hypotheses of the study and Third, secondary analyses, that explores findings in more depth (Jill G. Zwicker 2009).

3.1. Preliminary analyses: Were the groups equivalent prior to the start of intervention?

One-way analysis of variance (ANOVA) indicated that there was no statistically significant difference among the three intervention groups in terms of pre-test TSH sum scaled scores, F (2, 57) = 2.86, $p > .05$, $n^2 = .09$. There were no statistically significant differences between the three groups on pre-test NYPR Score, F (2, 57) = 0.14, $p > .05$, $n^2 = .005$. Therefore, results of preliminary analyses indicated that there were no significant differences between the three randomly assigned groups prior to intervention.

3.2. Primary Analyses: in relation to the hypotheses

Hypothesis 1

The first hypothesis, that there will be significant improvement in the handwriting skills and postural alignment of children who receive Brain gym program or Body Activated Learning program compared to the children who receive no intervention, was supported.

Handwriting skills

A repeated measures ANOVA of difference scores of TSH indicates that there was statistically significant difference between the handwriting skill score among

the three groups, Memory= $F(3, 56) = 28.94$, $p < .05$, $n^2 = 0.60$, Dictation= $F(3, 56) = 38.82$, $p < .05$, $n^2 = 0.67$, Copied= $F(3, 56) = 35.30$, $p < .05$, $n^2 = 0.25$.

When all three handwriting subscales were considered together there was statistically significant difference within the groups = $F(6, 112) = 3.822$, $p = .0001$; effect size (f) = 0.25.

Also, the large effect size between the BAL Group compared to the control group (d =1.88) and between the BG Group and the control group (d = 1.09) suggests the intervention was having some effect on Handwriting skills compared to no intervention.

Postural Alignment

One-way analysis of variance (ANOVA) was performed on the difference scores (posttest–pretest) to analyse the effectiveness of intervention on postural alignment. Result indicated that there was statistically significant difference among the three intervention groups scores, $F(2, 57) = 19.07$, p =0.00, $n^2 = 0.40$

The large effect size between the BAL Group compared to the control group (d =1.31) and between the BG Group and the control group (d = 1.29) suggests the intervention was having some effect on postural alignment compared to no intervention.

Hypothesis 2

The second hypothesis, that there will be significant improvement in the handwriting skills and postural alignment of children who receive Body Activated Learning program compared to the children who received Brain Gym program was also supported.

Handwriting skills

A comparison of the means of sum scaled score of TSH for the three groups showed a significant difference in the mean scores between the BAL group (pre-testing =59.65and post-testing =70.90, p=0.00) and the BG group (pre-testing =53.7and post-testing =62.65, p=0.00) and slight decrease in scores for control group (pre-testing =48.75 and post-testing =47.05, p>0.00), (Table-3). Indicating significant improvement in student's handwriting skills in BAL group compared to BG Group.

Postural Alignment

A comparison of the means of NYPR score for the three groups showed a significant difference in the mean scores between the BAL group (pre-testing =47.50 and post-testing =61.25, p=0.00) and the BG group (pre-testing=46.25and post-testing =60.75, p=0.00) and slight decrease in scores for control group (pre-testing =45.75 and post-testing =45.50, p>0.00), (Table-3). Indicating significant improvement in student's posture in BAL group compared to BG Group.

3.3. Secondary Analysis:

Was there a difference in the number of children who improved with each intervention?

Frequency counts were conducted to determine the percentage of children who showed improvement or no improvement for each intervention group as shown in Table-4

None of the children in the BG and BAL intervention group declined in performance. 5% students in memory subtest and 5% students in copied subtest didn't show any improvement in BAL group and BG group respectively. 5% students in BAL and 10% students in BG group showed no improvement in postural alignment. Majority of students in control group declined in handwriting skills and postural alignment.

3.4. Home Program Monitoring Checklist

The students in both BG and BAL groups were provided with the home program booklets as it was recommended to use the exercises regularly throughout the day. To make sure student's adherence to home program they were given a Home Program Monitoring Checklist. It was found that in 90% students in BAL group followed the home program regularly as compare to 75% students in BG group. (Table-5)

4. Discussions

This study was set out to compare the Effectiveness of Brain gym program versus Body Activated Learning program on 6-12 year old students' handwriting skills and postural alignment**.**

4.1. Body Activated Learning Program

Based on Table-3, result reflected an improvement in the handwriting skill and postural alignment for both the BG and BAL group. The average score of BAL group was slightly higher than BG group.

Effect of Body Activated Learning Program on Handwriting Skill

The data in Table-4 showed that the means of difference score of the individual handwriting subscales among 3 groups showed the largest improvements in the BAL group: memory scale (M = 16.60), dictated (M= 9.65) and copied scales (M= 7.0). The students in BAL group scored in a higher percentile than BG group, 95% students showed positive difference scores on memory scale and 100% on dictation and copied scale.

This result is supported by Julie Anderson (2016) who examined the impact of sensory-based movement activities on academic learning (reading, handwriting and maths skills).Students in the intervention group participated in six sensory-based

movement activities, twice daily, once in the morning and once in the afternoon. Results indicated the intervention group trended toward higher positive changes in all results as compared to the control group.

Effect of Body Activated Learning Program on Postural Alignment

The means of difference score of NYPR in table 4 showed the largest improvements in the BAL group (M=13.75). Frequency count revealed the higher percentile score in BAL group with 95% of students showed improvement in postural alignments.

Our result is supported by Jensen (2000) highlighted that classroom based movement program helps the student to improve posture, mood, focus and motivation. Movement provide the stimulus to brain, increase the levels of neurotransmitter and allows for processing time and provides a break from learning that allows the students to refocus. Sitting in any chair for more than a short (10-minutes) interval is likely to have negative effects on posture or physical health as it creates fatigue, which is bad for learning. Thus movement based sensory program play a very important role in improving the posture and work at desk.

Thus our results in line with these studies revealed that the students who had poor handwriting skills and postural alignment demonstrated significant improvement after implementing Body Activated Learning Program. While previous studies have assessed the impact of sensory-based movement to improve academic skills (Julie Anderson, 2016); this is the first study to explore the effects of Body Activated Learning Program on Handwriting Skills and Postural Alignment.

Reason for Effectiveness of Body Activated Learning Program

The positive effect on handwriting skills and postural alignment after these activities is due to increase in alertness (energize exercises), calming and organizing the sensory input to relax and centre the body for maximum focus and attention (restore exercises), engage the senses like active listening (activate exercises), enhance visual skills for writing (vision boost), and calming and organizing their bodies with vision break, stretching (regroup exercises). It is well known that control of posture is a complex multisensorial task based on vestibular, visual and somatosensory information. From the three sensory systems governing postural control, proprioceptive inputs are thought to have the greatest influence in the detection of body sway (Mallau S, Vaugoyeau M, Assaiante C, 2010) and the primary. Sensory components of *Body Activated Learning Program* activities include proprioceptive and vestibular input as well as visual tracking. Stretching also helps to reduce tension and promote better posture (Julie Anderson, 2016).

4.2. Brain Gym® Intervention

Data reflected that (Table-3), there was improvement in the handwriting skill and postural alignment for both the BG and BAL group within the study. But the average score of BG group was slightly lesser than BAL group.

Effect of Brain Gym Program on Handwriting Skill

Frequency count revealed that 100% students showed positive difference scores on memory and dictation scale and 95% on copied scale. (Table-4)

Our result was supported by Jose Ocampo, et-al (2017) and Kristen Keinath. (2005), they analysed the effectiveness of Brain Gym® movements in enhancing writing performance of grade 1 pupils. The result showed that not only the ability of the students to write increased but also the students started to write neatly. Moreover, the time taken to do tests became less after implementation of brain gym.

Effect of Brain Gym Program on postural alignment

Frequency count revealed that 90% of students showed improvement in postural alignments (Table 4)

Jane Alexander (2011) showed the effectiveness of Brain gym program in improving postural instability. A simple series of exercises could help your brain function better, making you sharper, smarter – and far more confident. THE ENERGISER is a midline movement. This keeps the back muscles toned and the spine supple, flexible and relaxed. It improves posture and concentration and is very useful for those who work at desks and computers. Thus Brain Gym helps to relax the system, support alignment, release tensions and inviting new motor patterns.

Thus our research in line with these studies has proven that there was significant improvement in handwriting skills and postural alignment after implementing Brain Gym Exercises. Brain Gym integrates the left and right hemispheric functions of brain. It draws our innate gifts and talents and brings about "whole-brain" learning.

Reason for Effectiveness of Brain Gym Program

According to Paul Dennison and Gail Dennison the effectiveness of Brain Gym program depends on few factors:

Whether or not you choose the specific Brain Gym activities that most benefit each child's needs: We make sure that Brain Gym exercises was selected

according to the child's need by referring Brain Gym Teacher's edition.

How often they do the activities (daily is recommended): A home program was given to all the students and home program monitoring checklist was given to each child to make sure the home program to be followed.

Whether the children enjoy doing the activities: we make sure the implementation of a Brain Gym program in interesting and playful manner and in less-restrictive environment

How well each activity is taut, whether each child experiences the physical skills involved in each activity: we make sure that the teaching tips for each activity given in Brain Gym Teacher's.

Why the performance of students in BG group was slightly lesser than BAL group.

The explanation is related to the intensity and frequency of intervention was less among children BG group as compared to BAL group. The author of Brain Gym Program recommended the use of exercises regularly during the morning routine and throughout the day and hence the Home program was provided to students, along with home program monitoring checklist. The analysis of home program monitoring checklist revealed that percentage of student's adherence to home program was less in BG group (75%) as compare to BAL group (90%) - Table: 5

Mitchell and Kemp (2000) highlighted that adherence to home program can be challenging and concluded that adherence to home program ranges from 40-70% only. Peggy L. Delton et-al (2006) and Zwicker (2009) also found the same results; there was sizeable improvement with cognitive intervention compared to multisensory intervention and therapeutic practice found to be more effective than sensorimotor based interventions respectively.

Thus our results in line with these studies suggested that Body Activated Learning Program was more effective than Brain Gym program.

4.3. Limitations

First, this study had a small sample size. Only 8 students of 6-8 years and 12 students of 9-12 years old participated in the study. All of the students were from the same geographic area thus; the scope of the study was limited primarily to the population of one area. Secondly the study was limited to the length of treatment program i.e. 8-week period over which the study took place. This short time period limits the accuracy of the data that was collected. Third limitation of the study was group intervention which didn't allow one-on-one interaction with the students.

4.4. Future Recommendations

Several recommendations for future research can be identified from the findings of our study. Future studies could focus on the larger sample size from more than one school of different geographic area this will provide a better representation of the population. Studies could also focus on extended time length of the intervention for at least one school year; this will provide the opportunity to perform the exercise with regularity. Future studies could also consider the Effectiveness of Brain Gym, Body Activated Learning program or other movement based programs on other academic areas such as Executive functioning skills, Perceptual Motor skills, and Visual perceptual skills.

5. Conclusion

Within the study it was found that 33.33% of children had problem with handwriting as measured by HPSQ and 60-70% students had poor postural alignment as measured by New York Posture Rating Scale. Our study concluded that the handwriting skills specially writing from memory, dictation and copying and postural alignment significantly improved following Brain Gym and Body Activated Learning program as compared to control group. This study had provided evidence that Body Activated Learning Program was more effective than Brain Gym program for addressing handwriting skills and postural alignment. Thus school teachers must be encouraged to utilize some time on these exercises regularly during the morning routine and throughout the day. Overall this study suggested that such movement based programs can be utilized for enhancement of handwriting skills and postural alignment for school children.

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Ethical clearance: Verbal consent and written consent were taken from each child's parents/guardian who participated in the study.

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Table 1: Brain Gym Intervention

Session-1	Handwriting skills	Lazy 8, PACE, Arm activation, Space buttons and earth buttons
	Postural alignment	Energizer, Neck rolls,
Session-2	Handwriting skills	Lazy 8, PACE, Double doodles, Belly breathing, Positive points.
	Postural alignment	Gravity glider, the grounder
Session-3	Handwriting skills	Lazy 8, PACE, Arm activation, Space buttons and earth buttons, Calf pump
	Postural alignment	Energizer, Neck rolls,
Session-4	Handwriting skills	Lazy 8, PACE, Double doodles, Positive points, Belly breathing, Balance button
	Postural alignment	Gravity glider, the grounder
Session-5	Handwriting skills	Lazy 8, PACE, Thinking cap, Energy yawn, Balance buttons, Calf pump
	Postural alignment	Energizer, Neck rolls,

Table 2: Body Activated Learning Program

Sessions	Energising	Activating	Regrouping
Session-1	Body wakeup Sprinkler left/right	Body tap Chair push-ups Vertical shifts	Shoulder roll Head massage
Session-2	Front chop left/right Ladder climb up/down	Partner handshake Desk pound top/bottom Horizontal shifts	Eye cupping Stretch it out
Session-3	Cross chop left/right Rope pull up/down	Star throwing Piano finger Near/Far shifts	Shoulder roll Head massage

Session-4	Body wakeup Sprinkler left/right	Spinning hi-5 Finger pushups Horizontal shifts	Eye cupping Stretch it out
Session-5	Cross chop left/right Rope pull up/down	Windmill Desk pound left/right Vertical shifts	Shoulder roll Head massage

Table 3: Mean, SD, t values for different factors

Variables (N=60)	PRE M±SD	POST M±SD	t-value	Significance level
BAL Group				
NYPR	47.50±10.57	61.25±13.94	6.51	0.00**
TSH = Memory	77.55±13.04	94.15±16.65	9.31	0.00**
Dictation	87.25±10.98	96.90±12.14	10.28	0.00**
Copied	92.05±13.18	99.05±11.06	8.59	0.00**
Sum Scaled Score	59.65±14.2	70.90±11.96	15.43	0.00**
BG Group				
NYPR	46.25±10.86	60.75±12.16	8.01	0.00**
TSH = Memory	76.30±16.95	86.65±15.71	10.13	0.00**
Dictation	86.50±10.03	95.80±9.25	11.55	0.00**
Copied	90.40±13.56	97.45±13.06	7.27	0.00**
Sum Scaled Score	53.7±13.53	62.65±15.13	5.40	0.00**
Control Group				
NYPR	45.75±9.90	45.50±11.45	-0.195	0.423 NS
TSH = Memory	76.15±16.60	75.20±16.37	-2.89	0.004*
Dictation	85.65±9.32	85.55±9.57	-0.69	0.246 NS
Copied	91.25±13.49	89.60±13.17	-6.01	0.001*
Sum Scaled Score	48.75±13.59	47.05±13.31	-3.24	0.002*

*: significant at 0.05 level, **: significant at 0.01 level, NS: not significant

NOTE: Analyses showing subtle differences between the BG, BAL and Control Group.

Table 4: Percentage of Children with Declining Performance, No Change or Improvement in posture and handwriting skills per Intervention Group

	Negative Difference Scores	No Improvement (Difference = ±1%)	Positive Difference Scores	Difference M±SD
BAL Group				
NYPR	0%	5%	95%	13.75±9.44
TSH = Memory	0%	5%	95%	16.60±7.96
Dictation	0%	0%	100%	9.65±4.19
Copied	0%	0%	100%	7±3.64
Sum Scaled Score	0%	0%	100%	11.25±3.25
BG Group				
NYPR	0%	10%	90%	13.15±8.66
TSH = Memory	0%	0%	100%	11.65±6.74
Dictation	0%	0%	100%	9.30±3.59
Copied	0%	5%	95%	6.1±3.22
Sum Scaled Score	0%	0%	100%	8.95±7.40
Control Group				
NYPR	35%	40%	25%	-0.25±5.72
TSH = Memory	60%	40%	0%	-0.95±1.46
Dictation	60%	25%	15%	-0.10±0.64
Copied	15%	85%	0%	-1.65±1.22
Sum Scaled Score	30%	60%	10%	-1.70±2.34

Note. Difference scores were calculated as posttest–pretest

Table 5: Percentage of student's adherence to home program

N=40	BAL group		Brain Gym Group	
	Frequency	Percentage	Frequency	Percentage
students not followed home program	2	10%	5	25%
students followed home program	18	90%	15	75%